

Flap striae after LASIK can be treated successfully

Following a few key rules leads to positive outcomes, surgeons say.

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Special to OCULAR SURGERY NEWS

LASIK is a treatment for the correction of myopia, hyperopia and astigmatism. It has advantages over photorefractive keratectomy, such as less postoperative pain and more rapid recovery, but complications can still occur. One complication is flap striae that can form on the corneal flap after it is cut with a microkeratome. Although the incidence of flap striae in most refractive surgeons¹ offices is usually under 5%, it is nonetheless one of the most common complications of LASIK.

According to Ernest Kornmehl, MD, striae are usually more the surgeon's fault rather than the patient's. To prevent striae from occurring, the surgeon must allot an appropriate amount of manipulation to the flap. After reshaping the exposed cornea with an excimer laser, the surgeon must reposition the corneal flap back to its original position over the stromal bed, usually using sponges and forceps. If any wrinkling or misalignment occurs, flap striae may form (figure 1).

Treatable striae

Striae are formed from the thinner, finer superficial flap and are found at Bowman's membrane. The three types that can form are pseudostriae, stromal folds or reticular microstriae. Pseudostriae occur because of a loose epithelium, stromal folds are radial or curvilinear and reticular microstriae are fine lattice lines in Bowman's membrane.

According to Rick Gibraltar, MD, of the New York Eye & Ear Infirmary, the key is not to treat all striae. One should first distinguish striae from folds.

Immediately after LASIK, some residual striae are often visible, but may completely disappear the next postop day. Striae outside the visual axis are relatively harmless. One example are the peripheral striae shown in figure 2. Only striae in the visual axis that cause astigmatism or affect best corrected visual acuity should be treated. Folds, in contrast, are thick and wrinkled and should be treated as soon as possible.

Penny Asbell, MD, of the Mount Sinai Medical Center says large refractive errors usually related to flap placement < if the hinge is a bit askew, or when trying to get the flap to sit in a deep stromal bed > can lead to macrostriae, or folds. Microstriae, which are harder to correct, are more likely to occur with very thin flaps.

If flap striae form they should be identified on the first postop day. Most refractive surgeons agree that flap striae should be treated as soon as possible when they are visually significant. If significant striae are not treated within the first 2 weeks after surgery, they may become imbedded in the corneal flap tissue and become difficult to remove.

Causes, predictors of striae

The striae that can form from LASIK occur in many ways. It is more common in ages over 40, and in high myopes because of the ³tenting² effect, which is caused by the greater depth of tissue ablation needed to reshape the cornea. The greater ablation alters the original flap-stromal bed relationship, creating a tent when the flap is placed back onto the stroma. Striae can also form by misalignment of the corneal flap after flap replacement, photophobia or by movement of the corneal flap during the first postop day.

Eye rubbing, excessive blinking or eyes squeezing from pain are some common patient behaviors that contribute to the formation of flap striae. Figures 3 and 4 show dislodged flaps, which can result from eye rubbing or trauma. Most surgeons agree that in general, striae are caused by excessive flap manipulation.

Eric Donnenfeld, MD, of TLC Laser Eye Center, said people with map-dot-fingerprint dystrophy, epithelial defects, trauma, lid spasms and those who squeeze their eyes a lot tend to get striae.

Other predictors of striae are thin flaps, flaps with large hinges that can have significant torque and those who receive nasal hinged flaps as opposed to superior hinged flaps, according to Jonathan Talamo, MD, author of a textbook on laser vision correction surgery, *The Excimer Manual*.

Emil W. Chynn, MD, discussed his surgical procedure for minimizing unnecessary flap handling.

³I used to "squeeze" the flap back in place using a moistened cellulose sponge, a method I was taught during my fellowship at Emory. Recently, George Waring III, MD, said they have modified their original technique to minimize flap manipulation. Since I have switched to this "refloat/minimum touch" technique, my incidence of striae has been reduced.²

Detection of striae

While the causes and predictors may prepare LASIK surgeons for what to expect postop, early detection of striae in any patient is still crucial. Flap striae can occur within the first hour after LASIK, so surgeons take measures to detect striae as soon as possible. The first step is to examine the patient at the slit lamp 20 minutes after surgery. On every postop checkup a corneal topography should also be performed. If visual acuity is not near 20/20 or is worse than preop acuity, or if astigmatism is present, flap striae or wrinkling may also be present.

The presence of wrinkling or striae must then be confirmed to indicate if flap manipulation is necessary. The traditional method is to dilate the patients' pupils and examine their corneas under a slit lamp by retroillumination. If striae are found, the flap edges are marked; the flap is refloatated and then realigned into a more correct position after striae have been removed.

Often the realignment will not match the markings, indicating a repositioned flap. Retroillumination can then provide a more accurate localization of any striae or wrinkles that are still present. Residual striae from the surgery usually appear because the flap has been stretched into place. These usually disappear within 24 hours. Improvement in visual acuity should be seen within 4 days after treatment.

A new method of assessing the presence of striae is by examining the tear film after instilling fluorescein in the patient's eye. The tear film created after blinking is examined at the slit lamp with a cobalt filter. Uneven pooling of the tear film after blinking is an indication of flap striae (figure 5). The surgeon can then treat the striae in the same manner as the traditional method.

Treatment based on postop time

Dr. Asbell recommended diagnosing where the folds are before treating. If they are within the epithelium, do not treat them, and floating the flap will not help, she said. If they are within the stroma, first try refloating as soon as the diagnosis is made and considered visually significant.

Reticular micro-striae can be treated with a bandage contact lens, punctal plugs or lubrication medicine. If these striae still persist after 2 weeks of this treatment, they should be treated like the other types of striae.

For treating pseudostriae and stromal folds detected within 2 weeks, most surgeons carefully dissect the corneal flap along the edge, flip it back and

hydrate it with a filtered hypotonic saline mix. The mix allows the flap to expand and become more malleable to facilitate the removal of striae.

The flap can then be floated and stretched into position to adhere back to the stromal bed, which takes about 3 to 5 minutes. Stretching is done with blunt forceps on the epithelial surface of the flap by pushing the flap edges gently but firmly away from the central cornea (the area of the deepest excimer ablation). This allows the flap to fill in the ablated stromal bed. Figures 6 and 7 show that the striae have been eliminated by the applying the stretching technique.

Dr. Asbell said that for deep folds, repositioning is best. If striae are on the more superficial part of the stroma, they may represent BM changes or dystrophy, and they may be harder to treat. They may respond to removal of the epithelium, hypotonic drops or sterile water or a bandage contact lens.

Some surgeons remove a small layer of epithelium and then use a bandage contact lens to reduce the occurrence of further wrinkling. This has been successful for cases with epithelial defects, in thin or perforated flaps. Striae detected or treated after 2 weeks may be treated by the same method. If the striae appear to be imbedded, a 4-mm or 5-mm layer of epithelium can be removed, the striae can be stretched out and a bandage contact layer can be applied.

New instruments and methods

Some surgeons have begun moving away from using saline; instead, they stretch the striated flap for about 8 minutes with forceps. Others use special ironing and stretching instruments such as Rhein's Johnston Applanator, the Tress Kornmehl Press, the Pineda LASIK Iron, Acorn's Donnenfeld Striae Removal Spatula or the Herzig compressor.

A new method for treating striae is currently being tested, and thus far has proven to be successful for treating long-standing or persistent striae, as well as dislodged flaps. Such striae are being treated with sutures. Some surgeons use five interrupted sutures to treat such striae. Dr. Waring uses 8-bite anti-torque sutures after floating the flap in order to hold the flap in place. Dr. Talamo prefers not to use sutures, and only uses them if all other treatment fails, or if the flap is thin or torn. In any case, this new method has been very successful in improving patients' BCVA.

No universal treatment

There is no one universal method for treating every case of striae. Striae that occur in the visual axis can be approached by refractive surgeons in many ways, depending on the type and severity of the striae and the postop time it was detected. Although most surgeons prefer to refloat the flap and use a specialized instrument to stretch out the striae, late detection of striae will force the application of methods that are not preferred, such as removing the epithelium, using a bandage contact lens and suturing the flap.

No matter which method is used to correct flap striae, it is important to keep in mind that early detection is a crucial factor in successful treatment. Patients with high myopes and epithelial defects; thin, torn or incorrectly sized flaps; those who receive nasal instead of superior hinged flaps; and those with flaps that undergo excessive manipulation are at higher risk for developing striae. By keeping these factors in mind, refractive surgeons can increase their success in treating striae simply by detecting them at a very early stage.

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Figures

All figures are from Probst LE. *LASIK: A Color Atlas and Surgical Synopsis.* Thorofare, NJ: SLACK Incorporated; 2001.

Figure 1. Vertical striae due to flap movement after LASIK.



Figure 2. Peripheral flap striae demonstrated by retroillumination.

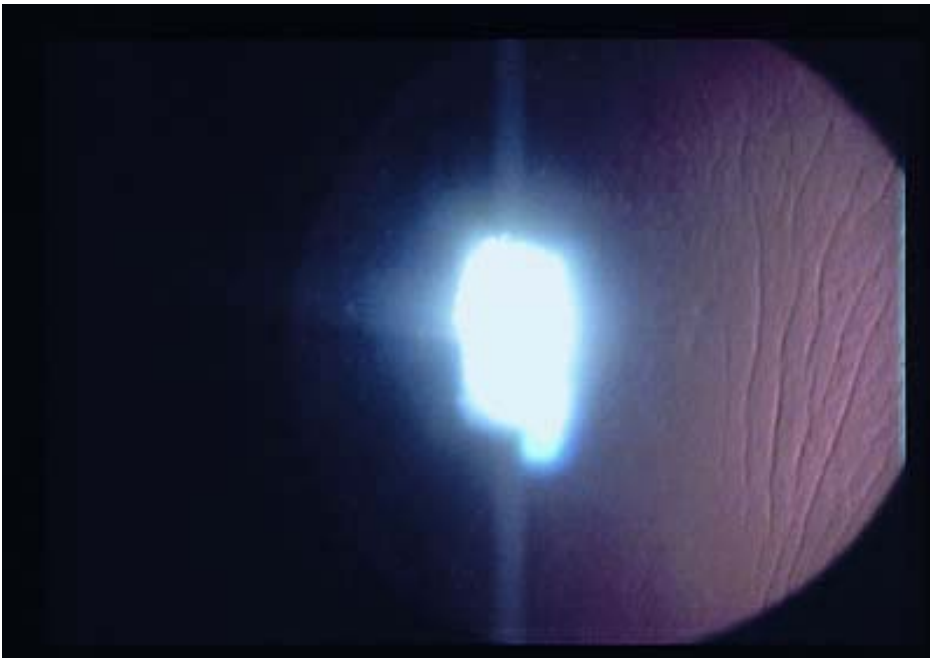


Figure 3. The corneal flap is dislodged after rubbing.

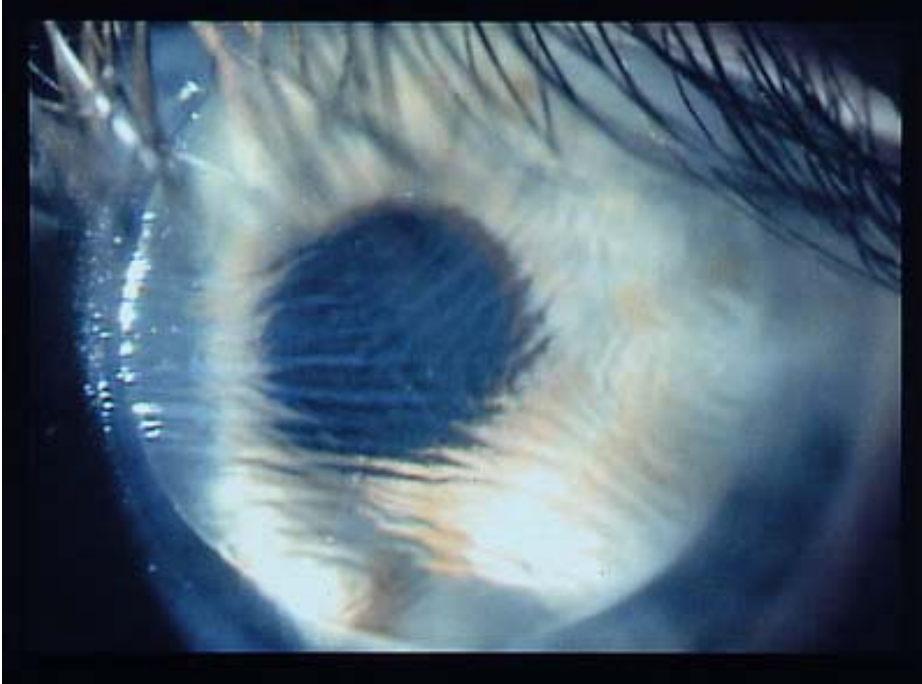


Figure 4. The corneal flap is dislodged and folded.

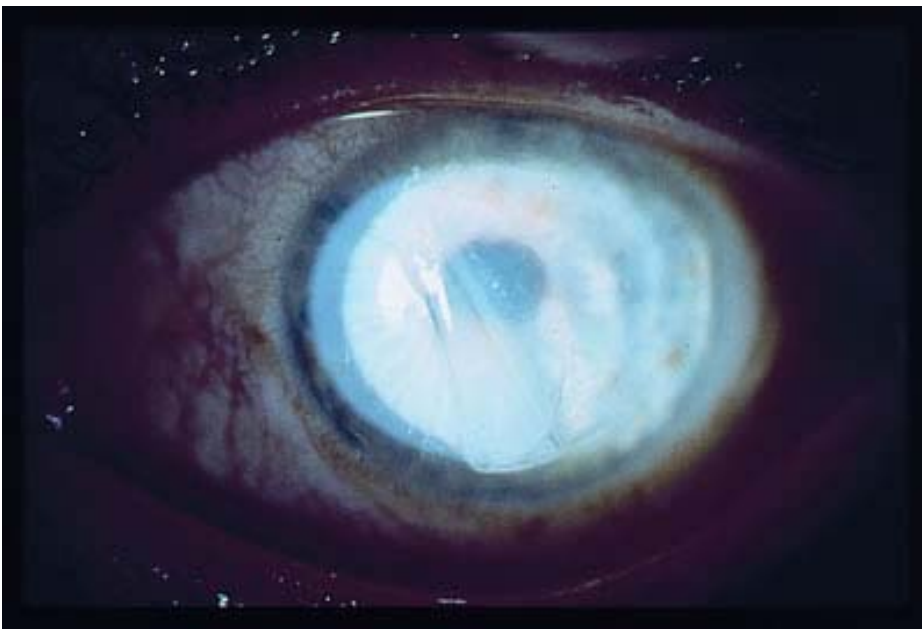


Figure 5. Horizontal striae after myopic LASIK are shown here by fluorescein staining

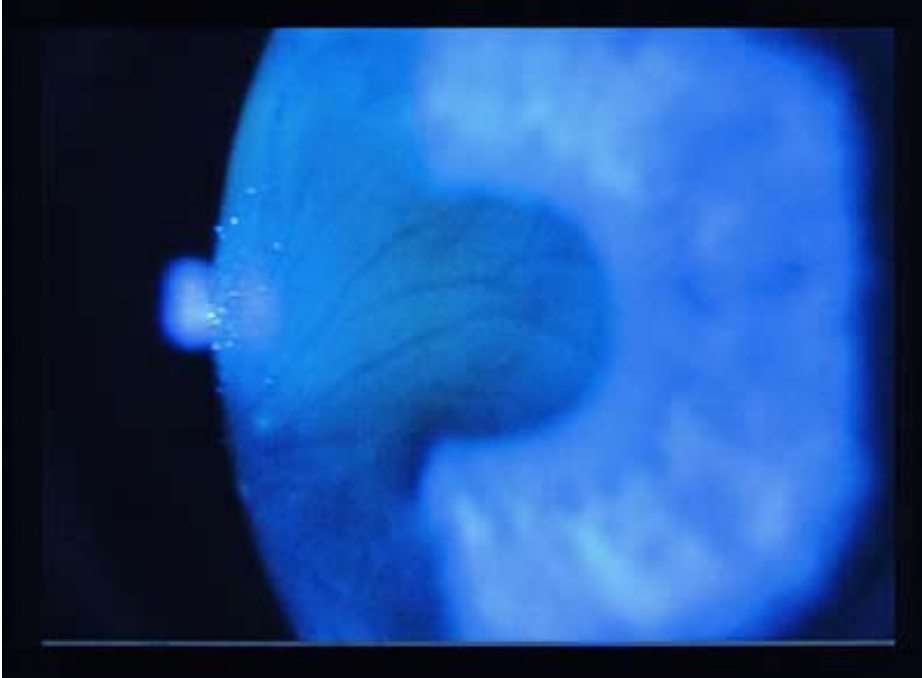


Figure 6. Oblique striae are visible by retroillumination.

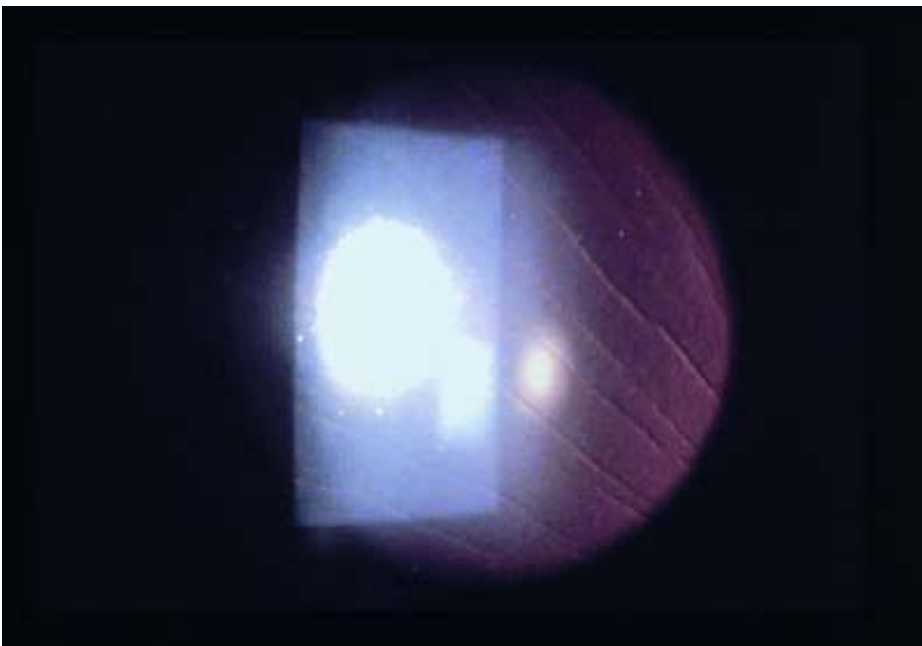


Figure 7. The same striae in Figure 6 are now eliminated after the flap has been stretched into place.

